Visual search based on synesthetic color without overt attention

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Background

Color-graphemic synesthetes experience "color" when viewing achromatic alphanumeric characters. Previous studies have suggested that synesthetic colors behave like real colors in tasks where color is important. For example, some studies reported faster or more accurate performance by synesthetes searching for an achromatic inducing target among other achromatic distractors relative to normal controls [1,2]. However, other studies found that synesthetes enjoy no advantage over control subjects [3].

Aim of the study

These seemingly contradictory results in the synesthesia literature might stem from methodological differences such as stimulus conditions, tasks, and measures. Therefore, we employed a visual search paradigm with various conditions while varying viewing conditions in consideration of the angular size of the search array as well as the angular subtense of each item [4].

Methods

Subjects: 3 Korean color-graphemic synesthetes and 3 matched controls

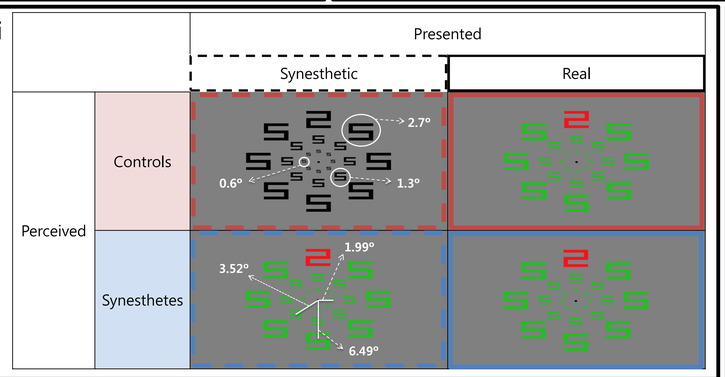
Conditions
- Set size : small – 12, medium – 18, large – 24
- Color : real, synesthetic
- Eccentricity : near, intermediate, far
- Viewing : free, fixed

Task : a speeded judgment detecting the target

Number of trial : free - 1152 (real -576, synesthetic -576)
fixed - 1152 (real -576, synesthetic -576)

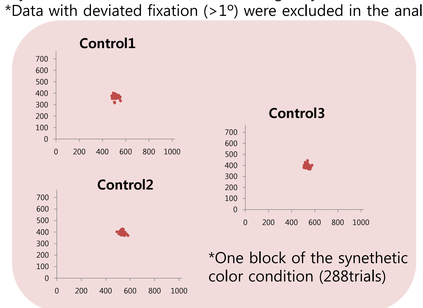
*Data with RTs longer than 4s or shorter than .3s were excluded in the analysis

Stimuli

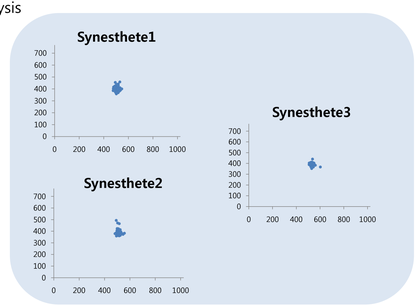


Fixation monitoring

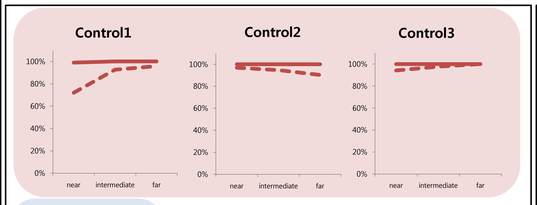
*EyelinK 1000 (SR research), 1000hz, Right eye
*Data with deviated fixation (>1°) were excluded in the analysis

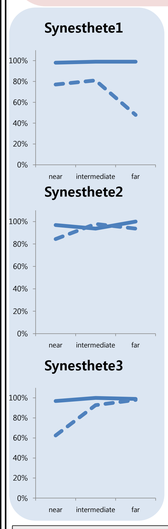


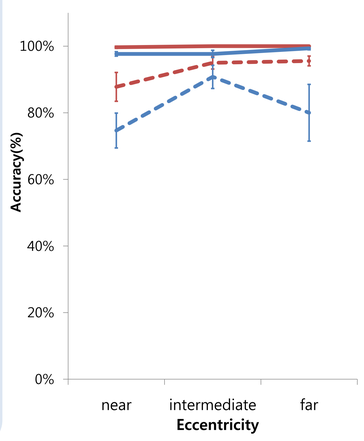
*One block of the synethetic color condition (288trials)



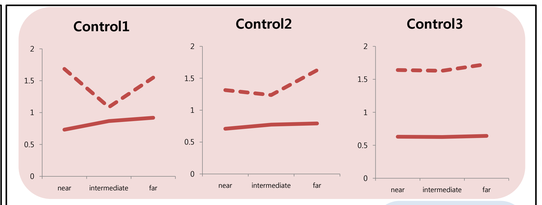
Results <Experiment 1 : Free viewing>

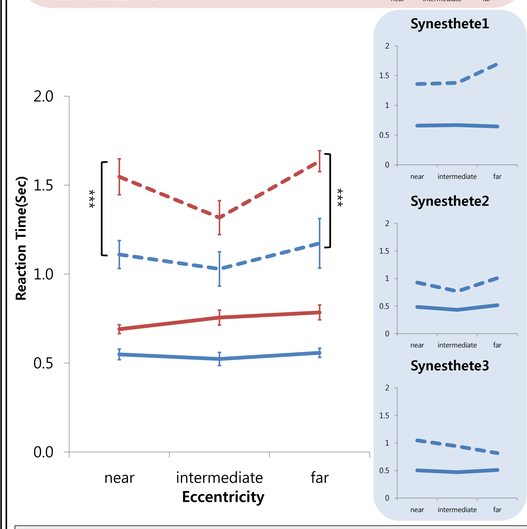






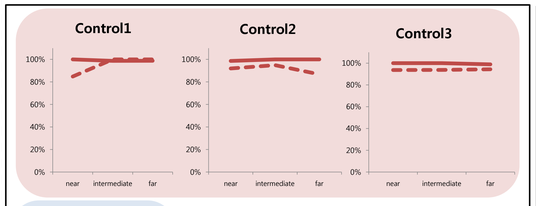
Accuracies for the synesthetes and the matched controls were not significantly different either in the real or in the synesthetic color task.

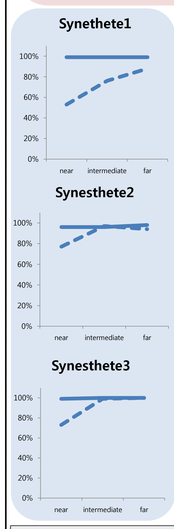


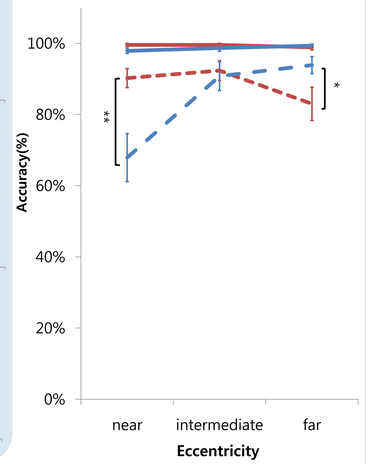


RTs for the synesthetes and the matched controls were significantly different in the synesthetic color task, but not in the real color task.

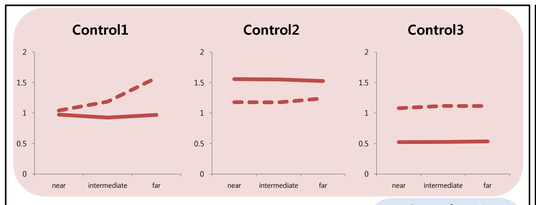
<Experiment 2 : Fixed viewing>

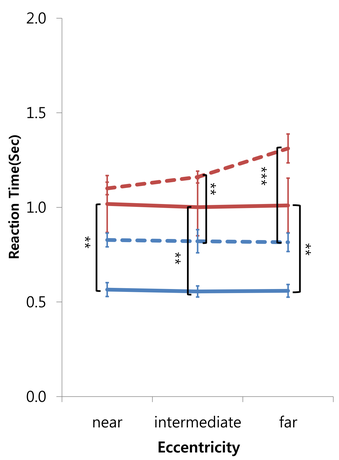


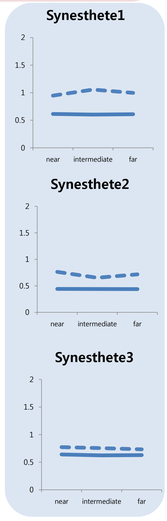




Accuracies for the synesthetes and the matched controls were significantly different in the synesthetic color task, but not in the real color task. The synesthetes were more accurate searching the target than the matched controls in the far condition, but not in the near condition.



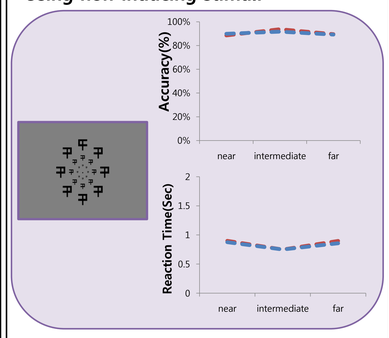


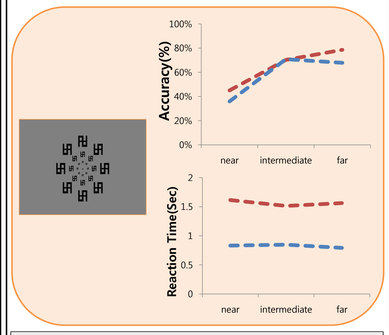


RTs for the synesthetes and the matched controls were significantly different in the synesthetic color task.

<Experiment 2-1>

*Using non-inducing stimuli





Performances of both the synesthete and the matched control were vulnerable to the change of stimuli, particularly in the near condition.

The synesthetes were faster searching the target than the matched controls in the synesthetic color task.

• Real : the synesthetes were faster than the matched controls searching the target despite the comparable accuracies.
• Synesthetic : the synesthetes were more accurate and faster searching the target in the far eccentricity condition.

Conclusion

The present results imply that synesthetes are better than matched controls finding a "colored" target with or without overt attention.

Reference

[1]Palmeri, T. J. et al., 2002, *Proceedings of the National Academy of Sciences*
[2]Smilek, D. et al., 2001, *Journal of Cognitive Neuroscience*
[3]Edquist, J. et al., 2006, *Cortex*
[4] Anstis, S. ,1974, Vision Research

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